circular space on the surface of the tin plate almost clear of resin, showing how very much the surface-tension of hot resin is less than that of cold resin.

Note of January 30, 1886.—The equations (8) and (9) on p. 59 of Clerk-Maxwell's article on "Capillary Attraction" in the ninth edition of the "Encyclopædia Brittanica" do not contain terms depending on the mutual action between the two liquids, and the concluding expression (10), and the last small print paragraph of the page are wholly vitiated by this omission. The paragraph immediately following equation (10) is as follows:—

"If this quantity is positive, the surface of contact will tend to contract, and the liquids will remain distinct. If, however, it were negative, the displacement of the liquids which tends to enlarge the surface of contact would be aided by the molecular forces, so that the liquids, if not kept separate by gravity, would become thoroughly mixed. No instance, however, of a phenomenon of this kind has been discovered, for those liquids which mix of themselves do so by the process of diffusion, which is a molecular motion, and not by the spontaneous puckering and replication of the boundary surface as would be the case if T were negative."

It seems to me that this view is not correct; but that on the contrary there is this "puckering" as the *very beginning* of diffusion. What I have given in the lecture as reported in the text above seems to me the right view of the case as regards diffusion in relation to interfacial tension.

It may also be remarked that Clerk-Maxwell, in the large print paragraph of p. 59, preceding equation (1), and in his application of the term potential energy to E in the small print, designated by *energy* what is in reality exhaustion of energy or negative energy; and the same inadvertence renders the small print paragraph on p. 60 very obscure. The curious and interesting statement at the top of the second column of p. 63, regarding a drop of carbon disulphide in contact with a drop of water in a capillary tube would constitute a perpetual motion if it were true for a tube not first wetted with water through part of its bore—". . . if a drop of water and a drop of bisulphide of carbon be placed in contact in a horizontal capillary tube, the bisulphide of carbon will chase the water along the tube."

Additional Note of June 5, 1886.—I have carefully tried the experiment referred to in the preceding sentence, and have not found the alleged motion.

WILLIAM THOMSON

OUR FOSSIL PSEUDO-ALGÆ

DURING the last half-century many palæontologists have described anomalous objects, some of which have been regarded as fossil marine Algæ, and others as tracks of various marine invertebrate animals; and since the publication of Darwin's theory of evolution various attempts have been made to utilise some of these in formulating a pedigree for the living types of vegetation. Amongst those who have tried to accomplish this object my distinguished friend the Marquis of Saporta, and his colleague, M. Marion, occupy the most prominent position. They have in several publications described and figured many objects which they believe to have been true marine Algæ, and out of which they have constructed the lower roots of their genealogical tree. But meanwhile there has grown up an enlarging school of palæontologists who look with strong suspicion upon these genealogies; who refuse to recognise the vegetable character of these objects; who believe most of them to be casts of various ridges and furrows, most of which have been tracks produced by creeping invertebrate animals or by the still more mechanical agencies of wind and water. At the head of this school Prof. Nathorst, of Stockholm, stands pre-eminent. An animated controversy sprang up some time ago between M. Nathorst and M. Saporta relative to this subject. Blast and counterblast have succeeded one another, and the latest discharge of palæo-botanical artillery has just been fired off by M. Nathorst in the form of a memoir entitled "Nouvelles Observations sur des Traces d'Animaux et autres Phénomènes d'Origine purement méchanique décrits comme 'Algues Fossiles.'"

Enjoying the privilege of an intimate and valued friendship with both these distinguished palæontologists, I am anxious to do full justice to both. But I must admit that my judgment and experiences bring me into closer agreement with the northern naturalist than with his French antagonist. The interesting subject discussed by them has long occupied my attention, and my conclusions respecting it have not been hastily arrived at.

The question in debate is not whether or not marine Algæ existed in Palæozoic and later geological epochs: on this point Nathorst and Saporta are agreed. The abundance of phytophagous marine mollusks found even in the Cambrian, as in most of the other fossiliferous strata, clearly demonstrates that there must have been submarine pastures upon which they could feed. The question is, are numerous objects, found in strata of marine origin, and believed by some to be fossilised marine Algæ, really such? To this query Saporta answers *Yes;* Nathorst's reply is an emphatic *No.* Hence the elaborate controversial literature of which these two *savants* are the authors. To condense their several articles into an abstract is not easy, but such an abstract of M. Nathorst's latest publication may be attempted, illustrating the general features of the discussion.

Throughout his memoir M. Nathorst rests prominently upon two general propositions which appear to me to be unanswerable. The first is that all or nearly all these debatable pseudo-Algæ stand out in bold demi-relief from the *inferior* surfaces of the rocky slabs to which they are attached, and that beyond their sculptured surfaces they as constantly consist of a mere extension of the rock of which they form a part. Hence Nathorst insists that they are merely convex casts of what were primarily concave grooves or channels on the surface of the subjacent stratum.

In reply to this opinion M. Saporta publishes figures of casts of vegetable fragments in demi-relief, the positions of which on the inferior surfaces of slabs are identical with those of the pseudo-Algæ under discussion. One of these is a fragment of what appears to be a twig of a Conifer, of which the lower side alone is preserved in demi-relief. Nathorst freely admits the possible existence of such specimens, but he regrets Saporta's explanation of them. *Imprimis,* he affirms with inexorable logic, that such examples are so rare and exceptional that they only prove the opposite of the rule which they are alleged by Saporta to sustain. Whenever fragments like these are found embedded in the rocks, they almost invariably display traces of both their upper and lower surfaces; whereas this is scarcely ever the case with the disputed Fucoids, and in the very few instances where such are supposed to have been met with, their entirely exceptional character suggests a very different explanation of them from that proposed by M. Saporta.

It is difficult to understand how a cylindrical object sufficiently dense to produce a deep concave impression upon hardening mud could do so without leaving some trace of its upper surface upon the opposite surface of the sand by which that mud became overlain. Saporta's theory explaining why it does not do so is surely untenable. That theory supposes that an organism half embedded in mud and overlain by sand began to decay at its *upper* surface, which decay ultimately reached the lower surface which rested on the mud; that, as the decay proceeded downwards, the superimposed sand would finally reach the concave mould in the mud which it would fill, and

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of which it would permanently preserve the form. Nathorst replies that the decay would follow no such downward course; that it would commence in the softest tissues, wherever they were; and that in such objects as Bilobites and Cruziana, which Saporta believed to be cellular and fistular objects, whilst their outer surfaces were sufficiently hard and resisting to impress their sculpturings upon the underlying mud, the decay would commence in their interior, with the result, in each instance, not of destroying all traces of the upper surface whilst the lower one was preserved, but that both surfaces of the flattened organism would be preserved, as is the case with the Carboniferous Sigillaria and Lepidodendra. Once thus flattened, the organism would no longer be capable of producing the deeply concave groove in the clay to which the specimens in bold demi-relief have been due.

This part of the controversy furnishes Nathorst with another argument. However much compressed, embedded fragments of vegetable matter almost invariably retain some traces of their primitive carbonaceous constituents, however thin the film thus preserved may be. As in the case of many of the Monte Bolca Fucoids, this may be no more than a faint brownish stain on the surface of the stone; whereas such stains, suggestive of the former permanent presence of organic matter, are almost invariably, if not wholly, absent from the pseudo-Fucoids.

In his new memoir M. Nathorst then proceeds to examine in detail the claims of several well-known genera to rank as members of the vegetable kingdom. I must refer such as are interested in the details of this controversy to the original memoir of the Swedish palæontologist. I would only observe that, whilst M. Nathorst denies the accuracy of some of M. Saporta's statements as to the facts in certain instances, in others on which the two palæontologists are agreed he shows that the acknowledged facts are capable of such explanations as lead to conclusions diametrically opposed to those arrived at by M. Saporta.

One of the most important features of M. Nathorst's new memoir is seen in his illustrations. He has invented some simple instruments, by rolling which over some plastic materials he produces impressions, casts of which recall most strikingly the objects known by the generic titles of Cruziana and Harlania.

Whatever ultimate decisions may be arrived at respecting these debated objects, I am compelled to arrive at a conclusion which I have already announced on more than one previous occasion. When it is possible for two observers so experienced as are M. Nathorst and M. Saporta to study the same objects and to arrive at such opposite determinations as to their organic or inorganic character, we must at least conclude that objects capable of receiving such contradictory explanations can have no value when we are considering the evolution of the vegetable kingdom. The evidences of the witnesses in such a controversy must be clear in their testimony and indisputable as to their antecedents.

Manchester, August 11 W. C. WILLIAMSON

NOTES

A TELEGRAM from Grenada, August 16, states that the British observing party for the eclipse of the sun on the 29th inst. has arrived there, and has divided into two. Messrs. Lockyer, Turner, Perry, and Maunder are going to Green Island and Grenville Bay, on the east side of Grenada, and to Carriacou, a small island to the north. Messrs. Darwin, Thorpe, Schuster, and Lawrence will take up their station at Prickly Point, Hog Island.

THE seventeenth meeting of the German Anthropological Society was formally opened on the 11th inst. at Stettin. The gathering is described as a very representative and distinguished one.

THE Yorkshire Naturalists' Union fungus foray will take place on Thursday, September 30. On the following day there will be an exhibition of the specimens in the Leeds Museum, kindly lent for the purpose; and in the evening the usual dinner. Several distinguished mycologists have promised to be present, and no effort is being spared on the part of the officials to make it a success.

LORD DUFFERIN is, it is stated, about to address a memorandum to the Provincial Governments of India regarding technical education, pointing out where the present system fails, suggesting remedies, advising the adoption of a more practical system, and inviting opinions from the Provincial Governments on the whole subject.

WE have received the Smithsonian reports on the progress of physics and mineralogy for the past year. The former is by Prof. Barker, the latter by Prof. E. S. Dana. Physics is treated under the heads general, mechanics (with the subtitles solids, liquids, gases), acoustics, heat (sub-titles production of heat, expansion and change of state, conduction and radiation, specific heat), light (production and velocity, reflection and refraction, dispersion and colour, interference and polarisation), electricity (magnetism, electric generators, electrical units and measurements, electric spark and electric light), obituary, and bibliography. Mineralogy, similarly, is treated under the heads general, crystallography and physical mineralogy, chemical mineralogy, new mineral localities, new minerals, papers on mineral species, bibliography, and obituary.

THE Smithsonian Report for the past year contains a most interesting paper on the "Volcanic Eruptions and Earthquakes in Iceland within Historic Times," translated and condensed from the work of Th. Thoroddsen, by Mr. George Boehmer. The original work appears to be one of enormous research and thoroughness. Mr. Boehmer divides his subject into early accounts, position of the active volcanoes, of which there are eight groups, with a sketch of each, chronological list of volcanic eruptions and earthquakes in Iceland, and finally an extensive bibliography of the volcanoes, earthquakes, and geysers of Iceland.

THREE severe shocks of earthquake occurred at Malta, the first at 8.30 p.m. on August 14, the second at 3.45 a.m. on August 15, and the third at noonday. Three fresh shocks were felt on the evening of the 17th, the first at 5.45, the second at 6.20, and the third at 7.45. They were not so violent as those experienced on Saturday and Sunday, and no damage is reported.

MR. H. B. GUPPY is completing his work on the Solomon Islands and their natives, which will shortly be ready for the press. The work will refer chiefly to the anthropology and geology of this region. It will also treat of the botany, natural history, meteorology, and general resources of these islands, and there will be appended an account of the original discovery of the group as related in the British Museum manuscript of Gallego's "Journal." The chief value of Mr. Guppy's observations will lie in the circumstance that his collections have been examined by the leading authorities on the subjects to which they relate. He hopes to illustrate the work from his own photographs.

WITH reference to Mr. Verbeek's investigations into the Krakatão eruption, which were noticed in NATURE, vol. xxxiii. p. 560, we have received a letter from Herr Retgers, Mining Engineer in Samarang, stating (as indeed Mr. Verbeek had already stated in his work) that the whole of the mineralogical investigations into the composition of the volcanic ashes then thrown out were carried out by him.

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